HENRY W. STONE

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EDUCATION:

Ph.D., Electrical Engineering, Carnegie-Mellon University, 1986.
M.S., Electrical Engineering, Carnegie-Mellon University, 1983.
B.S., Electrical Engineering, Carnegie-Mellon University, 1981.

Ph.D. Dissertation: Kinematic Modeling, Identification, and Control of Robotic Manipulators.

EXPERIENCE:

Project Element Manager/Senior Engineer: Jet Propulsion Laboratory, November 1997 - Present.

Responsible for the technical, administrative, and financial management of the Mars Sample Return (MSR) 03/05 Rover Control and Navigation Subsystem. The subsystem is tasked with the design, fabrication, assembly, functional test, environmental test, and ultimate delivery of the flight unit rover's onboard electronics, navigation sensor, cameras, and onboard control software and all breadboards, brassboards, and models thereof. At present, the subsystem team is comprised of approximately 35 individuals (~ 20 FTEs) with a very wide range of backgrounds ranging from software developers to focal plane designers to mechanical designers. The Control & Navigation Subsystem job is estimated to cost approximately $20M.

Data Controller, Mars Pathfinder Mission Operations Team: Jet Propulsion Laboratory, July 1997 - November 1997.

Responsible for leading the team in charge of analyzing the telemetry data returned by the Mars Pathfinder Microrover (Sojourner) and Lander during surface operations and for making near real-time assessments of the health and state of the vehicle as part of the overall mission operations activities. In preparation for surface operations, became responsible for designing and coordinating the development of the rover's LabView-based downlink analysis tools and for designing and implementing all of the rover specific Ground Data System tools used to acquire rover data from the project telemetry data base system. Also was responsible for the design, implementation, and maintenance of the rover telemetry archiving system.

Technical Manager: Jet Propulsion Laboratory, August 1992 - November 1997.

Responsible for the technical, administrative, and financial management of the Mars Pathfinder Microrover (Sojourner) Control and Navigation Subsystem. The subsystem was tasked with the design, fabrication, assembly, functional test, environmental test, and ultimate delivery of the flight unit rover's onboard electronics, navigation sensor, cameras, and onboard control software and all breadboards, brassboards, and models thereof. The subsystem team is comprised of approximately 20 individuals (~ 12 FTEs peak) with a very wide range of backgrounds ranging from software developers to electronic designers to mechanical designers. The design of the Control & Navigation Subsystem included the design of several new and innovative techniques for detecting the presense of terrain obstacles via a CCD and Laser-based ranging system and for safely controlling the vehicle as it drives in an unknown hazardous environment given extreme computational limitations. The Pathfinder mission and that of the Sojourner rover was a tremendous success and is currently viewed as a model for the success of subsequent missions. The success of the Sojourner vehicle, due in part to the contributions made by the Control & Navigation Subsystem, has clearly opened up a new era in planetary exploration in which rover's will be a key ingredient.

The Mars Pathfinder project was successfully designed, developed, tested, delivered, and launched in only 3 1/2 years. The Control and Navigation Subsystem portion was delivered on time for $6M.

Task Manager, Jet Propulsion Laboratory, August 1990 - December 1992.

Task Manager for the Emergency Response Robotics Project. Project was aimed at the development of a mobile robot to assist HAZMAT Teams in the localization, characterization, identification, and mitigation of spills involving hazardous materials/chemicals. Responsible for providing key technical leadership and overall project management. Task draws upon expertise in the design and the development of large integrated robotic and telerobotic systems. Project is funded by NASA's Office of Aeronautics, Exploration, and Technology.

Member of Technical Staff, Jet Propulsion Laboratory, April 1987 - August 1990.

Member of the Run-Time Control Subsystem team, one of several teams/subsystems responsible for the design, implementation, and test of advanced control algorithms used on the JPL Telerobotic Testbed System. The testbed integrated the technologies of teleoperation, manipulator control, machine vision, task planning/diagnosis, and world modeling, to perform various tasks associated with inflight servicing and repair of spacecraft (e.g., Earth Orbiting System and the Hubble Space Telescope). Primary technical responsibility was the development of the Run-Time Controller (RTC) subsystem, a key component of the overall control system. Key contributions included the development and implementation of algorithms for analyzing and controlling the motion of multi-degree-of-freedom manipulators near kinematic singularities. Additional responsibilities included the roles as System Operations Engineer, Testbed System Integration Lead Engineer, and Assistant Task Manager.

PATENTS:

An Emergency Response Mobile Robot for Operation in Combustible Atmospheres, NASA Case No. NPO-19020-1-CU, (In Review).

Hazardous Materials Emergency Response Mobile Robot, NASA Case No. NPO-18690-1-CU, (In Review).

AWARDS:

NASA Exceptional Achievement Award, June 1998 (for contributions to the success of the Mars Pathfinder Mission).

AFFIRM (Association for Federal Information Resource Management) Innovative Leadership Award (For leading the design of the Mars Pathfinder Microrover Control & Navigation Subsystem).

PUBLICATIONS:

Stone, H. W., Design and Control of the MESUR/Pathfinder Microrover, In *Proceedings of the 1993 International Conference on Advanced Robotics*, Tokyo, Japan, November 1993. (Invited Paper, Referred)

Stone, H. W., Design and Evaluation of a Mobile Robot for Responding to Chemical Hazards, In *Proceedings of the 40-th Conference on Remote Systems Technology*, Chicago, Ill, Vol. 2 1992. (Invited Paper, Referred)

Wilcox, B., Matthies, L., Gennery, D., Cooper, B., Nguyen, T., Litwin, T., Mishkin, A., and Stone., H. W., Robotic Vehicles for Planetary Exploration, In *Proceedings of the 1992 IEEE International Conference on Robotics and Automation,* Nice, France, May 1992. (Invited Paper, Referred)

Stone, H. W. and Edmonds, G., HAZBOT: A Hazardous Materials Emergency Response Mobile Robot, In *Proceedings of the 1992 IEEE International Conference on Robotics and Automation,* Nice, France, May 1992. (Invited Paper, Referred)

Stone, H. W. and Edmonds, G., HAZBOT: A Hazardous Materials Emergency Response Mobile Robot, In *Proceedings of the 1992 International Symposium on Robotics and Manufacturing*, Santa Fe, NM, November 1992. (Refereed)

Stone, H. W., Edmonds, G., and Peterson, K., The JPL Emergency Response Robotics Project, In *Proceedings of the 1991 Joint Army-Navy-NASA-Airforce Interagency Propulsion Subcommittee Meeting on Safety and Environmental Protection*, Kennedy Space Center, FL, July 1991.

Balaram. J. J. and Stone. H. W., Automated Assembly in the JPL Telerobot Testbed, Intelligent Robotic Systems, Desrochers A. A., editor, Kluwer Academic Publishers, Boston, November, 1991.

Backes, P., Kan, E. P., Lee, T., Lokshin, A., Stone, H. W., and Tso, K., Telerobotics for Space Assembly and Servicing --- Final Report, Jet Propulsion Laboratory Technical Document (JPL D-7875), Pasadena, CA, October, 1990.

Stone, H. W., Balaram, J. J., and Beahan, J. Jr., Experiences with the JPL Telerobot Testbed : Issues and Insights, NASA TechBrief (No. NPO-17928), NASA, August 1991.

Stone, H. W., Balaram, J. J., and Beahan, J. Jr., Experiences with the JPL Telerobot Testbed : Issues and Insights, NASA Conference on Space Telerobotics, Pasadena, CA, January 1989.

Stone, H. W., et. al., Polar Platform Robotic Servicing Evaluation: FY 88 Laboratory Results, Jet Propulsion Laboratory Technical Document (JPL D-6047), Pasadena, CA, 1988.

Stone, H. W. and Sanderson, A. C., Statistical Performance Evaluation of the S-Model Arm Signature Identification Technique, In *Proceedings of the IEEE International Conference on Robotics and Automation*, Philadelphia, PA, April 24 -- 29, 1988. (Refereed)

Stone, H. W., Kinematic Modeling, Identification, and Control of Robotics Manipulators, Kluwer Academic Publishers, Boston, 1987.

Stone, H. W. , and Sanderson, A. C., A Prototype Arm Signature Identification System, In *Proceedings of the IEEE International Conference on Robotics and Automation*, Raleigh, NC, March 30 --- April 3, 1987. (Invited Paper, Referred)

Stone, H. W., Sanderson, A. C., and Neuman, C. P., Arm Signature Identification. In *Proceedings of the IEEE International Conference on Robotics and Automation*, San Francisco, CA, April 14 -- 17, 1986. (Refereed)

Stone, H. W. and Neuman, C. P., Dynamic Modeling of a Three Degree-of-Freedom Robotic Manipulator. *IEEE Transactions on Systems, Man and Cybernetics*, SMC-13(3), July, 1984. (Refereed)

Stone, H. W. and Neuman, C. P., Dynamic Modeling and Control of Robotic Manipulators, In *Proceedings of the 27-th Midwest Symposium on Circuits and Systems*, West Virginia University, Morgantown, WV, June 11-12, 1984. (Invited Paper, Referred)

Stone, H. W. and Neuman, C. P., MRAC Control of Robotic Manipulators. Narendra, K.S. editor. In *Proceedings of the Third Yale Workshop on Applications of Adaptive Systems Theory*, Yale University, New Haven, CT, June 15-17, 1983. (Refereed)